283035

JPRS-UES-85-008

16 August 1985

DTIC QUALITY INSPECTED 2

USSR Report

EARTH SCIENCES

19981217 143

0
57
AØ4

USSR REPORT

EARTH SCIENCES

NOTE

JPRS publications contain information primarily from foreign newspapers,
periodicals and books, but also from news agency transmissions and broad-
casts. Materials from foreign-language sources are translated; those
from English-language sources are transcribed or reprinted, with the
original phrasing and other characteristics retained.

Headlines, editorial reports, and material enclosed in brackets [] are
supplied by JPRS. Processing indicators such as [Text] or [Excerpt] in
the first line of each item, or following the last line of a brief,
indicate how the original information was processed. Where no processing
indicator is given, the information was summarized or extracted.

Unfamiliar names rendered phonetically or transliterated are enclosed in
parentheses. Words or names preceded by a question mark and enclosed in
parentheses were not clear in the original but have been supplied as
appropriate in context. Other unattributed parenthetical notes within the
body of an item originate with the source. Times within items are as
given by source.

The contents of this publication in no way represent the policies, views
or attitudes of the U.S. Government.

PROCUREMENT OF PUBLICATIONS

JPRS publications may be ordered from the National Technical Information
Service (NTIS), Springfield, Virginia 22161. In ordering, it is recom-
mended that the JPRS number, title, date and author, if applicable, of
publication be cited.

Current JPRS publications are announced in Government Reports Announcements
issued semimonthly by the NTIS, and are listed in the Monthly Catalog of
U.S. Government Publications issued by the Superintendent of Documents, U.S.
Government Printing Office, Washington, D.C. 20402.

Correspondence pertaining to matters other than procurement may be addressed
to Joint Publications Research Service, 1000 North Glebe Road, Arlington,
Virginia 22201.

USSR REPORT

EARTH SCIENCES

CONTENTS

ARCTIC AND ANTARCTIC RESEARCH

METEOROLOGY

SOME RESULTS OF STUDY OF BLOCKING LAYERS ON DAYS WITH VERTICALLY DEVELOPED
CLOUD COVER OVER CAUCASUS-CASPIAN REGION ON BASIS OF AEROSPACE INFORMATION

GORCHIYEV, A. A. and AGAYEV, T. D.

/Abstract/ A study of vertically developed clouds (Cu and Cb) in the presence
of blocking layers was made using surface and aerological data for the period
1958-1980 and space photographs (1974-1980). The investigations covered the
Caucasus-Caspian region. It was found, for example, that blocking layers are
present in 70% of the cases when vertically developed Cu and Cb are observed
over the Apsheron Peninsula. In more than 60% of all cases the lower boundary
of the blocking layers is in the layer 0.5-2.0 km. The lower boundary of Cu
is formed in the atmospheric layer 800-1,500 m and Cb in the layer 400-1,000 m.
The thickness of Cu varies from hundreds of meters to several kilometers, where-
as Cb can vary from a kilometer to several kilometers, sometimes reaching the
tropopause. Over the Apsheron Peninsula Cu and Cb are most frequently formed
in cold and moist air masses arriving from the north. The velocities of their
intrusion are 5-10 m/sec and 11-15 m/sec respectively. Near midday such types
of clouds can cover from several percent of the heavens to 70-80%; the horizon-
tal dimensions of individual clouds may be several hundreds of meters to 2-3 km.
During summer-autumn a breeze circulation makes a definite contribution to the
formation of cumulus clouds. An important factor determining whether the
blocking (inversion) layer will be penetrated by ascending movements is whether
the layer is "dry" or "moist." These and many similar generalizations were
drawn on the basis of surface and aerological data. Space photographs yield a
wealth of additional data and in many respects are superior to discrete obser-
vations. This is illustrated in specific examples. The results obtained in
such studies are useful in weather forecasting over great territories over
definite time intervals. Since different types of clouds are formed under
different thermodynamic conditions any region covered by these clouds is charac-
terized by identical meteorological conditions. Combining space photographs
with radiosonde observations it is possible to obtain a good idea concerning
meteorological factors over an extensive area in both vertical and horizontal
directions. Figures 4, tables 1; references: 9 Russian.
/282-530I/

SELECTION OF BASIC FACTORS FOR CALCULATION OF GEOPHYSICAL AND ECOLOGICAL RESULTS OF POSSIBLE NUCLEAR WAR

IZRAEL', Yu.A., Corresponding Member, USSR Academy of Sciences; USSR State Committee for Hydrometeorology and Environmental Control

[Abstract] Conferences held in 1983 in Washington and Moscow have led to the inescapable conclusion that "nuclear war would cause irreparable harm to the planet, to life on earth." Massing of nuclear explosions would be accompanied by complex physical and chemical processes developing in the environment leading to large-scale geophysical and ecological results. This article studies the long-term effects of such an event. Analysis of the major effects of nuclear war indicates that it would lead first of all to severe cooling of the planet for a period of weeks or months, a change in the radiation and electrical properties of the atmosphere, screening of solar radiation, then to a significant and persistent increase in temperature (for years), a breakdown of the terrestrial ozone layer and a significant increase in the flux of hard ultraviolet radiation. The massive death of various species of plants and animals would lead to a decrease in genetic and species variety, particularly in the tropical and northern latitudes. References 13: 9 Russian, 4 Western. [336-6508]

OCEANOGRAPHY

AEROSPACE AND SURFACE STUDIES OF TEMPERATURE IN BALTIC SEA

Leningrad LENINGRADSKAYA PRAVDA in Russian 12 May 85 p 4

[Text] The attention of researchers is again focused on the Baltic Sea.
Preparations have been completed for conducting a new comprehensive
oceanographic experiment in which scientists of the USSR and the German
Democratic Republic (GDR) will take part. Commenting on the tasks of this
international expedition, Candidate of Physical-Mathematical Sciences S. V.
Viktorov, the expedition's leader on the Soviet side, related:

"Can the temperature of sea water be measured from satellites? This proves to
be possible. Not only temperature but other characteristics of the water can
be measured. But how precise will data obtained from space be? This is to
be verified in the course of our comprehensive experiment, which will be con-
ducted simultaneously on three levels: on the waters of the sea, and from
airplanes and artificial Earth satellites.

"Under the GDR flag, the scientific research vessel 'A.D. Humboldt' will set
out for the Baltic Sea in mid-May. Associates of the Leningrad branch of the
State Oceanography Institute and of the GDR Academy of Sciences' Institute of
Oceanology will make measurements of the water's thermal characteristics and
optical properties from this ship. Plans call for making such measurements
also from two airplanes, an IL-14 and an AN-30, flying at different altitudes.
The paths of artificial Earth satellites of the 'Meteor' type will pass over
the area of the experiment. This experiment will be the third stage of the
expedition."

CSO: 1865/371
FTD/SNAP

3

PHYSICS INSTITUTE'S NUCLEAR SPECTROSCOPY LABORATORY

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 16 May 85 p 4

[Text] Development of new types of quantum generators; laser probing of the atmosphere and the sea; research in the fields of elementary-particle physics and theory of gravitation; development of methods of atomic and molecular spectral analysis for determining the composition of materials, monitoring production processes and assuring the quality of products--this is only part of the range of basic and applied work that scientists of the Belorussian Academy of Sciences' Institute of Physics are pursuing.

(A photograph showed S. Andrukhovich and A. Berestov, associates of the institute's laboratory of nuclear spectroscopy, preparing apparatus for an experiment.)

CSO: 1865/371
FTD/SNAP

NAVAL UNIT PREPARES NEW SERIES OF REFERENCE CHARTS

Moscow VODNYY TRANSPORT in Russian 18 May 85 p 4

[Article by V. Yeliseyev]

[Excerpt] Thousands of vessels are now sailing the world's oceans. It would be difficult to imagine safe navigation of these vessels without nautical charts. They are produced in our country at the Main Administration for Navigation and Oceanography of the USSR Ministry of Defense. One of this administration's divisions--the Central Cartographic Production Unit (TSKP) of the Navy--is the oldest Soviet marine cartographic enterprise.

Captain lst Rank S. Val'chuk, head of the TSKP, told about things the marine cartographers are working on, beginning with the "Atlas of the Oceans."

"The first two volumes of this atlas, which is a unique cartographic encyclopedia of the Pacific and Atlantic oceans, have been awarded the USSR State Prize. A third volume has now been published. It is devoted to the Arctic Ocean.

"Intense work is now in progress on the final two volumes--the fourth and fifth. One of them will be devoted to straits of the world's oceans, while the other, which is in a popular-science vein, bears the title 'Man and the Ocean.'

"Among the marine cartographers' latest and most interesting works is a new series of reference-information charts. This is the first time that such a publication has been undertaken in our country. They are not navigational charts in the literal sense. Their value lies in the fact that navigators who have these charts will not have to leaf through various reference manuals and guides before approaching every seaport or strait. The charts contain infor- mation on places where vessels can anchor most conveniently and safely, as well as recommended courses, navigational hazards, places which vessels are forbidden to visit, methods of communicating with port administrations, pilot services and emergency-and-rescue units, and similar information.

"The collection which the Soviet now possesses includes more than 12,000 different charts of the world's oceans. This is the largest collection of nautical charts in the world."

EXPERIMENTAL STUDY OF EQUILIBRIUM INTERVAL IN FREQUENCY SPECTRA OF WIND WAVES IN SEA OF FINITE DEPTH

ALEKPEROV, I. A., AKHMEDOV, N. I., GUMBATOV, A. I. ISMAYLOV, A. S.,
MAGERRAMOVA, S. G. and TATARAYEV, T. M.

[Abstract] The frequency spectrum is one of the most important characteristics
of surface wind waves, making it possible to compute the mean elements of waves
such as mean height, dispersion, mean period and energy of waves. However,
determination of the form of the spectrum has remained an essentially unsolved
problem. Along these lines the Phillips equilibrium hypothesis on the form of
frequency spectra has gained the widest acceptance (in wind wave spectra there
are some frequency intervals in which the energy distribution should be depen-
dent only on the physical parameters characterizing the formation of sharp
crests and collapsing waves). In these frequency intervals the spectral density
$S(\omega)$ is dependent on frequency ω as $S(\omega) = \beta g^2 \omega^{-5}$. This seems valid for
deep waters, but for shallow waters it appears to be inapplicable. S. A.
Kitaigorodski, et al. (J. OF. PHYS. OCEAN., 5, 1975) later generalized this
formula. The authors made a study to clarify this problem. The article gives
data on the frequency spectra of surface wind waves obtained at different
wind velocities for a depth of 7 m. The measurements were made in the Caspian
Sea in August 1983. An analysis revealed the legitimacy of use of the Phillips
and Kitaigorodskii formulas in the range of relatively low frequencies, but
there are deviations in the range of high frequencies ($f \geqslant 0.5$). Any final
solution of the problem requires a thorough study of swell and currents jointly
with surface wind waves. Figures 2, tables 1; references 10: 8 Russian,
2 Western.
[282-5303]

FEATURES OF ELECTRICAL MEASUREMNTS IN SEA AS MEDIUM WITH FIELD OF EXTRANEOUS FORCES

LOPATNIKOV, V. I., Geophysical Institute, Ukrainian Academy of Sciences, Kiev

[Abstract] Electrical measurements in the sea involve both theoretical and technical difficulties because in any part of the sea there may be electrical fields generated by different sources but having a close spectral makeup. These include the telluric field associated with variations of the earth's electromagnetic field, extraneous and electrostatic fields associated with physicochemical processes and fields of biological, industrial and other origin. Electrical fields of dynamic origin determined by the Lorentz force are excited in the sea moving relative to the geomagnetic field. In addition, the measurement instruments themselves frequently have their own undermined motion in which a Lorentz force and undetermined emf can arise directly in moving parts of the measurement circuit. The article examines different possibilities for discriminating or excluding the effects of motion under specific conditions. Attention is given to discrimination of the telluric field, an electric field of dynamic origin and the vertically polarized electrical field caused by the vertical stratification of water masses. Various types of electrical field transducers are examined. The organization of electrical field measurements in a reference system fixed relative to the earth and the results of use of transducers of different types are also discussed. It is shown that within the framework of the electrodynamics of slowly moving media there is a possibility not only of using, but also excluding the electrical effects of movement in the magnetic field. The conclusions presented serve as a basis for different methods for measuring the electrical field in the sea when carrying out magneto-telluric soundings, investigating currents and the vertical physicochemical stratification of water masses. Figures 3; references 12: 11 Russian, 1 Western.
[307-5303]

PHASE OPERATOR METHOD IN PROBLEM OF SCATTERING OF ELECTROMAGNETIC WAVES ON IDEALLY CONDUCTING SURFACE

VORONOVICH, A. G., Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Moscow

[Abstract] Use of an S-matrix is common in a theoretical description of the scattering of electromagnetic waves on irregular surfaces because it relates

the amplitudes of the incident and scattered waves. In an earlier article by
the author (DAN, Vol 272, No 6, pp 1351-1355) it was proposed that a theory of
perturbations be developed not relative to the scattering matrix itself, as is
usually done, but relative to its logarithm. It was shown that with such an
approach even the first approximation gives results corresponding to the first
two approximations in the traditional perturbation theory. The approach pro-
posed in that article is now applied to the problem of scattering of an
electromagnetic wave on an ideally conducting surface: a monochromatic electro-
magnetic wave of a stipulated frequency is incident on this surface from above,
this surface consisting of plane (uniform and nonuniform) waves. A scattering
matrix is formed for vertically and horizontally polarized waves for such a
surface, as well as a matrix which the author calls a phase operator. With
this as a point of departure, a final form of the scattering matrix is proposed
for the first approximation (which can be used in subsequent approximations).
Not only is a solution of the formulated problem obtained, but the advanta-
geousness of the proposed approach over traditional perturbation theory is
demonstrated. References: 3 Russian.
/354-5303/

UDC: 551.465.4(269)

QUASIGEOSTROPHIC MODEL OF CIRCULATION IN ANTARCTIC OCEAN WITH PARAMETRIZATION
OF SYNOPTIC EDDIES

IVCHENKO, V. O. and KLEPIKOV, A. V., Arctic and Antarctic Scientific Research
Institute, Leningrad

/Abstract/ Prognostic models of large-scale oceanic circulations require
correct parametrization of synoptic scale disturbances, particularly for
zonal currents such as the Antarctic Circumpolar Current. Traditional semi-
empirical closure hypotheses generally do not reflect the interaction of
large-scale fields with synoptic eddies. Previous works have demonstrated the
correctness of the diffusion parametrization for the adiabatic invariant
potential eddy. The major feature of this approach is averaging of tensor
components k_{ij}. This tensor, characterized by four components, can be
represented as the sum of symmetric and anti-symmetric parts, the latter re-
lated to the so-called orientation effects, i.e., the systematic rotation of
fluid elements. This work studies only the diagonal components of the k_{ij}
tensor. The calculations confirm that in the region of the major zonal jet,
the Sverdrup balance is not satisfied. The vertical component of the tangential
wind stress rotor is balanced by divergences in the upper layer of the wind
flow of the potential eddy. In the lower layer an analogous eddy flow is
balanced by friction with the bottom. Figures 3, references 15: 5 Russian,
10 Western.
/336-6508/

ELASTIC HYSTERESIS IN MARINE SURFACE-ACTIVE FILMS

YERMAKOV, S. A. and TALIPOVA, T. G., Applied Physics Institute, USSR Academy of Sciences, Gorkiy

[Abstract] This work demonstrates that in addition to the elastic properties of marine surfactant films effects may occur characteristic for inelastic deformations of solids. Namely, hysteresis and relaxation effects are observed and studied in marine films, related to viscoplastic properties of the films. Isotherms of marine surfactant films were analyzed on the oceanographic platform of the Marine Geophysics Institute, Ukrainian Academy of Sciences, near the shore of the Black Sea in May-June 1983. Measurement of isotherms showed that for most marine films hysteresis does occur: the extension isotherm, when the film is returned to its initial uncompressed condition, lies below the compression isotherm. Zero pressure on the reverse isotherm corresponds to a certain residual 'plastic' deformation, while zero deformation corresponds to a residual negative pressure. Where the area of the hysteresis loop is greater, the greater the deformation of the film. Figures 2; references 8: 6 Russian, 2 Western.
[336-6508]

ESTIMATION OF INFLUENCE OF OCEAN ON DISTRIBUTION OF HEAVY METALS IN MARINE ATMOSPHERE

ANIKIYEV, V.V., IL'ICHEV, V.I., academician, LOBANOV, A.A. and MEDVEDEV, A.N., Pacific Ocean Oceanology Institute, Far Eastern Scientific Center, USSR Academy of Sciences, Vladivostok

[Abstract] The degree of enrichment of the surface microlayer with dissolved and suspended forms of Fe, Mn, Cu and Zn was determined at nineteen stations in various areas of the Pacific Ocean. The enrichment factors for the elements were calculated as the ratio of concentrations of dissolved and suspended forms of the heavy metals in the surface microlayer 250 μm thick and at a depth of 0.5 m. Total fluxes of metals from the ocean and factors of their enrichment in the atmosphere were calculated considering the possibility that the surface of the ocean is covered with an unsaturated surfactant monolayer. The influence of the ocean is found to be insufficient to explain the distribution of metals in the maritime atmosphere. References 14: 6 Russian, 8 Western.
[336-6508]

FOLDED STRUCTURES IN CENTRAL INDIAN OCEAN TRENCH

LEVCHENKO, O.V., MERKLIN, L.R. and NEPROCHNOV, Yu.P., Oceanology Institute imeni P.P. Shirshov, USSR Academy of Sciences

[Abstract] Continuous seismic profiling of the central Indian Ocean trench was performed during the 58th cruise of the research vessel "Vityaz'" in 1976, revealing large folded structures to the north of the trench and a zone of deformation of the sedimentary mass and basement at 5-7°S. Analysis of the continuous profiling data from this and two other cruises is used in this article to define the area of folded deformations with a northeasterly strike in the sedimentary mass. The tectonic structure of the deformed zone is discussed. The deformation area is tilted relative to the general submeridional (north-northwest) direction of existing stresses. It is postulated that there is a large shear zone with a northeasterly strike to the north of the Indian-Australian plate. Figures 3; references 20: 11 Russian, 9 Western. [242-6508]

REMOTE DIAGNOSIS OF MEDIA BY COMBINATION (RAMAN) ANTI-STOKES LIGHT SCATTERING METHOD WITH INDUCED BRILLOUIN BACKSCATTERING

BUNKIN, A. F., VLASOV, D. V. and GALUMYAN, A. S., General Physics Institute, USSR Academy of Sciences, Moscow

[Abstract] Nonlinear laser spectroscopy methods have not come into wide practical use although they have long demonstrated their advantages in the laboratory with respect to spectral and spatial resolutions, signal-to-noise ratio, and other characteristics. Among these nonlinear-optical methods is the method of combination (Raman) spectroscopy of anti-Stokes light scattering. It has been impossible to use this method in remote measurements due to the conditions of synchronism of the interacting waves (the pumping sources and the receiver of the registered signal lie on different sides of the investigated medium.) The article is devoted to an examination of the possibilities of remote sensing of the sea surface by this method. A modification of the method suitable for remote measurements was proposed earlier by the authors (A. F. Bunkin, et al., KVANTOVAYA ELEKTRONIKA, 10, 669, 1983; 10, 1902, 1983). In the proposed method the pumping wave is excited in the medium due to induced backscattering, especially induced Brillouin backscattering. With this taken into account, the article describes a general case of a nondegenerate scheme for remote

measurements. In contrast to the cases examined in the articles cited above, in which the minimum angles ensuring synchronism of the interacting waves were great, in this article it is shown that the angles can be as small as desired and collinear interaction is also possible. Developing these ideas, it is demonstrated that remote measurements can be made of the surface of water bodies by the methods of four-photon nonlinear spectroscopy of combination (Raman) scattering when there are small and zero angles between the interacting waves. Figures 2; references 10: 6 Russian, 4 Western.
[343-5303]

ACOUSTIC METHODS FOR MEASURING HIGH-FREQUENCY PART OF SPECTRUM OF SEA WAVES

NARODNITSKIY, G. Yu.

[Abstract] Measurements of the spectrum of ripples are very difficult. Possible approaches to solution of this problem are outlined. Some integral characteristics of ripples (rms values of ordinates, slopes and vertical velocities) can be measured by acoustic methods with vertical pulsed sounding of the surface provided that the linear dimensions of the irradiated sector are small in comparison with the length of large sea waves. The rms value for ripple slopes can be measured by the synchronous registry of the slopes of large waves and the intensity of backscattered ultrasonic signals. Methods for measuring the rms values of ordinates and vertical velocities of ripples are based on use of the correlation between these parameters and the corresponding frequency and time correlation intervals of fluctuations in the amplitude of backscattered ultrasonic signals. With the earlier work on this problem taken into account, revised formulas are derived for determining the rms values for the ordinates and vertical velocities of ripples. The article describes measurements of the characteristics of ripples when a vertical sounding transmitting-receiving system was situated at a height of about 7 m above the mean level of a water body. The frequency of the used ultrasound was about 40 KHz (wavelength 8 mm); the diameter of the irradiated sector at the 3-db level was 0.2 m. The formulas and methods given in the article are applicable in measurements from scientific research ships and the rms values for ordinates and slopes of ripples can be measured either at drift or while a vessel is proceeding on course. Figures 2; references 11: 10 Russian, 1 Western.
[358-5303]

OCEAN ALBEDO FOR ATMOSPHERIC THERMAL EMISSION

GARDASHOV, R. G., ZOLOTOVA, Zh. K. and SHIFRIN, K. S., Oceanology Institute,
USSR Academy of Sciences

/Abstract7 In computations of components of the radiation budget of the ocean
its surface albedo for atmospheric thermal emission χ is assumed equal to
$(1 - \varepsilon)$, where ε is surface emissivity, although in actuality $\chi \neq (1 - \varepsilon)$. A
study was made for evaluating χ under some mean standard conditions. It is
assumed that the brightness of thermal emission of the sky B and surface albedo
for direct radiation A_s are not dependent on azimuth $(B = B(\theta, \lambda)$ and $A_s =
A_s(\theta, \lambda)$, where θ is zenith distance, λ is wavelength). If $B(\theta, \lambda)$ is
replaced by the Planck function $B_0(T_w, \lambda)$ with the water surface temperature
T_w, the χ value is equal to $\chi' = 1 - \varepsilon$.   The θ values were computed earlier
(R. G. Gardashov, et al., IZV. AN SSSR: FAO, Vol 19, No 7, pp 771-773, 1983).
Atmospheric emission in the range 7-15 µm was determined using the formula
$B(\theta, \lambda) = B_0(T_w, \lambda) - f(\theta, \lambda)$. Albedo $A_s(\theta, \lambda)$ was computed in the approxi-
mation of the stochastically distributed areas method with different wind
velocities and with allowance for shading. Computations were made in the
spectral range 2.5 - 250 µm. The results of χ computations for a cloudless
atmosphere are given in a table. Computations are also given for a continuous
cloud cover. The χ values for a partial cloud cover can be obtained by inter-
polation. A formula is derived for effective emission of the ocean, based on
the difference between χ and χ'. A correction is introduced to take into
account the influence of a cold film on the sea surface. Tables 1; references:
6 Russian.
/358-53037

INVESTIGATION OF ELASTIC PROPERTIES OF MARINE SURFACE-ACTIVE FILMS

DEMIN, B. T., YERMAKOV, S. A., PELINOVSKIY, Ye. N., TALIPOVA, T. G. and
SHEREMET'YEVA, A. I., Applied Physics Institute, USSR Academy of Sciences

/Abstract7 The literature contains virtually no data on the stability of
surface-active films and the dependence of their characteristics on meteo-
rological conditions. Along these lines the authors could only locate the
study by H. Huhnerfuss, et al. (J. PHYS. OCEANOGR., Vol 7, pp 567-571, 1977),
describing the results of parallel meausrements of the surface tension of sea
water and wind velocity. Accordingly, the authors studied the dependence of

the elasticity parameter of films on wind velocity, studied the film relaxation effect and for the first time obtained the dependence of the film elasticity parameter on the concentration of surface-active agents. The measurements were made from an oceanographic platform in the coastal zone of the Black Sea in the autumn of 1981 and 1982. The apparatus used in measuring film parameters is described. It was found that the film elasticity parameter and the surface-active agent concentration on the average decrease with an increase in wind velocity to V $\approx$ 5-6 m/sec. An increase in these paramters is observed when there are stronger winds. The results obtained by Huhnerfuss and Garrett on a change in the properties of films with time were confirmed. The film relaxation time increases with an increase in wind velocity. There is a good correlation between the film elasticity values and the concentration of surface-active agent. It is emphasized that these conclusions are based on the results of measurements of sea films in the coastal zone and such investigations must be made in the open ocean. Figures 6; references 13: 7 Russian, 6 Western. /358-5303/

FLUORIMETER FOR IN SITU SEA WATER RESEARCH

KOSTKO, M. Ya., DUMEN, Yu. V., IL'YUSHONOK, A. V., KATSEVICH, S. P. and KNYUKSHTO, V. N.

/Abstract/ Fluorimetric methods are still being used inadequately in oceanic research despite their proven value. However, it has been clear that improvements are required in fluorimeters for use underwater and for this reason the authors devote the first part of this article to an outlining of the requirements which should be satisfied by such instruments. Emphasis is on the choice of the spectral range to be used and the band width for the exciting and recorded radiation; this choice must be made using data on the spectra of absorption and luminescence of the investigated substances. The second part of the article is a detailed description of the BF-1 fluorimeter developed by the authors and intended primarily for investigating the spatial-temporal characteristics of the intensity of luminescence of chlorophyll and dissolved organic matter in the upper layer of the ocean to a depth of 200 m. The instrument consists of surface and submersible units joined by a single-strand cable. The optical system of the fluorimeter and the arrangement of its parts is shown in Fig. 1 with 16 items identified. A block diagram of the electronic system is given as Fig. 2 with 22 components identified. These two figures serve as the basis for the textual discussion of structure and functioning of the instrument. The BF-1 combines such useful qualities as a high response, linearity, great dynamic range and small measurement constant. With small modifications it can be employed for measuring the spatial and temporal dependence of illumination and its fluctuations. The submersible unit weighs 35 k, is 850 mm long and has a diameter of 200 mm. The body of the instrument is made of stainless steel

and AMG-6 alloy. All optical elements (other than the interference filters) are of quartz. Some results of its in situ use (measurement of phytoplankton fluorescence) are given. Figures 4; references 16: 13 Russian, 3 Western. /376-5303/

STRUCTURE OF SEDIMENTARY COVER AND BASEMENT OF SIERRA LEONE RISE DETERMINED FROM COMMON DEPTH POINT SEISMIC DATA (EQUATORIAL ATLANTIC)

KARA, V. I., MAMOSHINA, K. N. and SHLEZINGER, A. Ye., Yuzhmorgeologiya /Southern Seas Geological Association/; Geology Institute, USSR Academy of Sciences

/Abstract/ A thorough study of the Sierra Leone Rise was made in 1979 by geophysical methods, including seismic work by the common depth point method, along runs with a total length of 2,500 km. This rise consists of two morphologically different sectors separated by a troughlike valley with an E-W orientation; the rise is separated from the continental margin of Africa by the basin of the same name. Crustal thickness within the rise is 13 km. The crustal section consists of a lower "basalt" layer with a thickness up to 8 km and a layer with densities 2.5-2.6 g/cm^3 with a thickness up to 5 km. In the basin the thickness of the consolidated crust does not exceed 6 km and belongs to the "basalt" layer. The article gives an analysis of bedding conditions, thicknesses and seismogeological characteristics of the sedimentary layers (deep drilling data are also used). It is concluded that the Sierra Leone Rise is a major volcanic shield with a total thickness as great as 4,000-5,000 m, overlying a melanocratic basement. In some sectors outpourings continued up to the Early Quaternary, resulting in formation of underwater volcanic mountains. The region became divided into uplifted and subsided sectors by the beginning of the Late Cretaceous. Subsequent volcanic activity occurred primarily in the rise. The structural plan of the present-day bottom of the rise was doubtlessly formed by Quaternary post-sedimentation differentiated descending tectonic movements. Figures 6; references 6: 3 Russian, 3 Western. /355-5303/

TECTONIC STRUCTURE OF SHIRSHOV RIDGE (BERING SEA)

NEPROCHNOV, Yu. P., SEDOV, V. V., MERKLIN, L. R., ZINKEVICH, V. P.,
LEVCHENKO, O. V., BARANOV, B. V. and RUDNIK, G. B., Oceanology Institute
imeni P. P. Shirshov, USSR Academy of Sciences; Geology Institute, USSR
Academy of Sciences

[Abstract] An interpretation of the geological structure of Shirshov Ridge,
until recently virtually unstudied, is regarded as highly important due to the
position of this ridge at the boundary between two abyssal basins of different
age. Only a full comprehension of its tectonic structure will cast light on
evolution of the Bering Sea region. A geological and geophysical study of this
ridge was made on the 29th cruise of the "Dmitriy Mendeleyev" in 1982. Dredging
was carried out, accompanied by continuous seismic profiling and deep seismic
sounding. The ridge extends in a submeridional direction for about 700 km and
has a width up to 130 km. In the north it is an underwater extension of the
Olyutorsk Peninsula, but with approach to the Aleutian arc it changes its
strike to sublatitudinal and at depths of about 3,600 m almost joins the Bowers
Ridge. A description of the three principal blocks of the ridge is given.
Continuous seismic profiling revealed that the ridge has an asymmetric structure.
Deep seismic sounding disclosed that crustal thickness beneath the ridge is as
great as 18 km. Three different rock associations were defined: a) amphibolites,
dolerites, quartzy dolerites; b) deep-water siliceous, siliceous-clayey and
tuffogenic-sedimentary deposits of Triassic, Late Cretaceous-Paleogene
and Oligocene age; c) slightly lithified siliceous and terrigenous deposits
of Neogene age. The totality of available data suggests that Shirshov Ridge
is a zone of crowding of the oceanic crust at the boundary of two differently
structured Bering Sea basins. Figures 6, tables 1; references 40: 13 Russian,
27 Western.
[355-5303]

EXPRESS METHOD FOR DETERMINING THERMOPHYSICAL PARAMETERS OF CONDUCTING SEDIMENTS

KALININ, V. V., Moscow State University imeni M. V. Lomonosov

[Abstract] The article describes a method for measuring the thermal conduc-
tivity coefficient χ and volumetric heat capacity coefficient ρC, based on
measurement of medium temperature after its pulsed heating by an electrical
current. The proposed method makes it possible to reduce the observation time

to a few or tens of seconds in comparison with a few or tens of minutes when using asymptotic and grid methods with probes presently used for in situ measurements. Since $\chi = \lambda/\rho C$, the second most important thermophysical parameter of the medium, the thermal conductivity coefficient λ is also determined. After discussing the theory of the method, equations are derived for determining the two parameters. The practical realization of the method involves fabricating a hollow spherical shell with good electrical and heat conductivity within which a temperature sensor is situated, with the shell itself being electrically coupled to the source of electrical current. The proposed heating method is entirely free of any need for placement of an electric heater within the probe, thereby eliminating many technical problems in its fabrication arising in the designing of deep-water probes introduced into sediments. The use of spherically symmetric electrodes, as proposed in the article, is not essential; a short cylinder, hemisphere, disk or plate may be preferable. Tables 1; references 7: 5 Russian, 2 Western.
[357-5303]

PRINCIPAL RESULTS OF GEOMORPHOLOGICAL INVESTIGATIONS IN NEIGHBORHOOD OF NAVARIN CANYON (NORTHWESTERN BERING SEA)

YEVSYUKOV, Yu. D. and VOLOKITINA, L. P., Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Moscow

[Abstract] On the 29th cruise of the "Dmitriy Mendeleyev" (23 June-10 July 1982) geomorphological research was carried out on the shelf in the neighborhood of the Navarin submarine canyon in the northwestern part of the Bering Sea over an area of about 44,300 km^2. More than 2,000 miles of runs were made with echo soundings and geophysical studies in a rectangular grid with the distance between runs being 12-24 miles. The longitudinal runs were 180 miles in length and the transverse runs 72 miles. This made it possible to compile bathymetric and geomorphological maps of the region, reproduced in the article. The canyon itself was studied within the limits of the shelf and the upper part of the continental slope. From the northeast to the southwest the canyon thalweg gradually drops off from 170 to 2,157 m. The shelf zone of this sector is characterized by level relief. The continental slope is complicated by different morphoelements, probably attributable to erosional, tectonic and other relief-forming processes. The bathymetric and geomorphological maps, in combination with geological and geophysical work, such as magnetometry, continuous seismic profiling and dredging of bedrock, will make it possible to define the history of geological development of this region. Figures 1; references 9: 7 Russian, 2 Western.
[357-5303]

FINE STRUCTURE OF DENSITY RELATION IN MAIN OCEANIC THERMOCLINE

ZHURBAS, V. M., Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Moscow

[Abstract] An important problem in studying fine thermohaline structure in the ocean is experimental clarification of the mechanisms of its generation. The best results have been obtained by an analysis of the ratio of the amplitudes of fine-structure temperature and salinity fluctuations. However, in cases (encountered very frequently in the main thermocline) when the thermohaline structure has a "steplike" character an analysis of the ratio of the amplitudes of T and S fine-structure fluctuations is inadequate for drawing any conclusions concerning the mechanisms by which the fine structure was formed. It is suggested that in such cases additional information could be obtained by an analysis of the fine structure of the density ratio

$$R\rho = \alpha\left\langle\frac{\partial T}{\partial z}\right\rangle \Big/ \beta\left\langle\frac{\partial S}{\partial z}\right\rangle .$$

Here $\langle \partial T/\partial z\rangle$ and $\langle \partial S/\partial z\rangle$ designate "fine-structure" vertical T and S gradients, that is, evaluations of vertical gradients averaged by depth to an adequate degree for excluding the microstructural variability and measurement errors, but retaining the changes of gradients in fine-struc ure elements. The author discusses the degree to which different mechanisms of generation of fine thermohaline structure can exert an influence on variability of the density ratio $R\rho$. It is indicated that in a stepped thermohaline structure formed as a result of interaction of intrusion processes and double diffusion (hypothetically, at least, occurring in the main thermocline) there will also be a fine structure of the density ratio. This will afford a possibility for distinguishing such a venture (for example) from the "steps" produced by local turbulent mixing. The validity of these conclusions was confirmed by probing of a stepped structure in the main thermocline in the tropical Atlantic on the third cruise of the scientific research ship "Akademik Mstislav Keldysh." Figures 1; references 8: 3 Russian, 5 Western. [357-5303]

VISCOUS NONLINEAR CIRCULATION IN AXISYMMETRIC BAROCLINIC EDDY

GORDEYCHEV, D. O. and SUTYRIN, G. G., Oceanology Institute imeni P. P. Shirshov,
USSR Academy of Sciences, Moscow

[Abstract] A study was made of vertical-radial movements arising in an
axisymmetric eddy as a result of the combined influence of nonlinear effects,
the most important of which are centrifugal force and the turbulent diffusion
of momentum, heat and salt. Specifically, the authors examine the evolution of
an axisymmetric disturbance in a rotating layer of stratified fluid in the
Boussinesq and quasistatic approximations. It is assumed that the coefficients
of turbulent exchange of momentum, heat and salt are equal to one another but are
different for the vertical and radial directions. The role of vertical diffusion
is evaluated using the value $K \sim 10^{-4}$ m^2/sec, characteristic for the main
thermocline. The comparative contribution of vertical diffusion is character-
ized by the dimensionless coefficient $K' = Kr_*^2/Az_*^2$. It is further assumed
that radial movements are related to a change in azimuthal velocity. Equa-
tions are derived describing the evolution of an eddy in dimensionless
variables. In this formulation of the problem a model is developed and examples
are presented showing that with identical coefficients of exchange of heat,
salt and momentum the joint influence of diffusional processes and non-
linearity results in a radial-vertical circulation of water, for the most part
due to centrifugal force. With small values of the Kibel'-Rossby number a
subsidence of water occurs along the axes of eddies in both cyclones and anti-
cyclones, but to a considerably lesser degree in the former than in the latter.
Figures 2; references 17: 5 Russian, 12 Western.
[357-5303]

FACIES-GENETIC GROUPS OF COARSE CLASTIC MATERIAL ON WORLD OCEAN FLOOR

KACHANOV, N. N., Geological Sciences Institute, Ukrainian Academy of Sciences,
Kiev

[Abstract] The author has compiled the first map of the geographical distribu-
tion of hard rocks on the ocean floor. A description of the position of frag-
ments in situ, the granulometric and morphometric parameters processed on a
computer using a special program, lithological and petrochemical data and age
determinations are evidence of a multistage character of the processes

involved in formation of fields of large clastic material, a diversity of conditions for the mobilization and accumulation of such material in recent and ancient layers of bottom sediments. New data on the development of such deposits at great depths afford possibilities for sounder conclusions in paleogeograhy. The facies and genetic characteristics of such deposits in the Atlantic, Pacific, Indian and Arctic Oceans are described. Important conclusions are drawn concerning the agents responsible for the transport of such material. In the Atlantic, for example, ice and icebergs played the most important roles, both in the Holocene and earlier. The greatest concentration of psephites is in the high latitudes (north of 25°N and south of 35-40°S), where ice and icebergs are and have been most common. However, gravitational processes have also played a role near the Mid-Atlantic Ridge, in shallow-water areas, in tectonically active regions and near strongly abraded rocky shores of continents and islands. A third source is biogenous in nature, such as in reefs and deposits of shells. Similar processes have been operative in all the oceans. The influence of hydrology, bottom geomorphology, climate and geotectonics is also examined. Areas with such deposits of rock materials and bedrock outcroppings usually are a favorite habitat of marine fauna and their study therefrom is of economic significance. Figures 1; references: 7 Russian. [378-5303]

SPATIAL STRUCTURE OF HIGH-FREQUENCY SEA WIND WAVES UNDER DIFFERENT METEOROLOGICAL CONDITIONS

STRIZHKIN, I. I., LAPCHINSKAYA, M. P., IL'IN, Yu. A. and MALINNIKOV, V. A., Moscow Institute of Geodetic, Aerial Mapping and Cartographic Engineers

[Abstract] Data are given from a study of the spatial structure of high-frequency wind waves in the range of wavelengths λ = 1.6-60 cm obtained in a photographic survey of the sea surface. The photoinformation on the wave-covered water surface was obtained in stereo- and monosurveys from a platform in the Caspian Sea. The survey was made with two synchronized AFA-41/7.5 aerial cameras from a height of 12 m; survey scale was 1:60; a single photograph covered an area of 28 m^2 on the surface. About 250 photographs of waves obtained under different meteorological conditions and with waves of different classes were processed for an analysis of the spatial distribution of ripples. The total area of water surface analyzed was 150,000-200,000 m^2. The survey was made in series of 5-25 photographs with intervals 2.5, 5 and 10 sec. It was found that with wind velocities from 5 to 18 m/sec the entire surface of the main wave is covered by sectors of capillary and capillary-gravity waves; these sectors have distinct boundaries. Within each sector the waves have a regular structure; in the case of steady waves the capillary and capillary-gravity waves are oriented primarily perpendicularly to the wind velocity, with deviations usually not exceeding 20°. There are two principal types of surface spatial distribution of capillary and capillary-gravity waves. In the

first on the surface of the sector there are 1-2 identical or somewhat different systems of waves, frequently oriented at an angle to one another. Sectors with 1-2 systems of waves are characteristic for capillary-gravity waves with a mean wave length $\bar{\chi}$ = 2.4-9.0 cm. In the second, wave systems are distributed not only over the surface of the sector, but are also situated on top of one another, forming ripples on ripples. When there are storm waves on the windward slope and in the trough of the main wave the first and second types of spatial distribution of waves are observed, whereas on the leeward side it is primarily the second type which predominates. The first type predominates for moderate and developing waves. Figures 2; references 8: 7 Russian, 1 Western.
/353-5303/

UDC 551.466.8

NONLINEAR INTERACTION BETWEEN SOLITON AND SHORT WAVES IN IDEAL FLUID

BENILOV, Ye. S., Oceanology Institute, USSR Academy of Sciences

/Abstract/ The problem of interaction of waves with considerably different spatial scales is examined. The objective was a determination of the steady form of a restructured soliton (when it is not destroyed by interaction with short waves) for gravity waves in a fluid. During interaction between short surface waves and internal waves resonance can develop, which results in a strong restructuring of both types of waves. The following problem is examined: there are two types of surface gravitational wave movements in an ideal fluid of the finite depth h with a free boundary -- long low-frequency waves (h/L $\ll$ 1), where L is their characteristic horizontal dimension, and quasimonochromatic short high-frequency waves (kh $\gg$ 1), where k is the wave vector of the carrier harmonic. It is assumed that the LF and HF waves propagate in the same direction. The entire analysis is made in a potential, slightly nonlinear approximation. The equations derived and the solutions which are found describe the propagation of a soliton of long gravitational waves on the surface of a fluid against the background of a quasiharmonic short wave. On this basis it was possible to obtain a generalization for a broad spectrum of short waves. A solution describing a solitary internal wave accompanied by a packet of short surface waves was obtained. References 7: 5 Russian, 2 Western.
/353-5303/

THE QUESTION OF EARTH EXPANSION AND ITS OCEANIC IMPLICATIONS

[Article by Vladimir Neiman, Cand. Sc. (Geology and Mineralogy): "Does the Earth Expand?"]

[Text] The hypothesis of Earth expansion was first advanced by Russian scientist I. Yarkovsky nearly a hundred years ago. The idea that it was a necessity for the Earth to expand was later given theoretical substance by noted modern physicists, Nobel laureates P. Dirac and P. Jordan, and Moscow University Professor D. Ivanenko, among others. Similar ideas were advanced by geologists and geophysicists Hilgenberg, Heezen, Carey, Soviet engineer Kirillov and many other noted scholars. The hypothesis continues to attract many scientists. What are the arguments in favour of it? What started the hypothesis?

The idea of Earth expansion was first suggested by Alfred Wegener in the 1920's. According to him, both Americas, Eurasia, Australia and Antarctica formed Panagaea, a single land mass with no oceans between the continents. (Figure 1 [omitted])

But the hypothesis of the continents have "drifted apart" like ships over many thousands of kilometres contradicts physics. In particular, both the Earth's crust and its mantle which underlies the crust are solid and any appreciable sliding of one solid substance (the crust) across the other (the mantle) is simply impossible.

However, the continents have still moved apart. So what is the reason for this?

The first geologic grounds for this were provided by Hilgenberg. He assumed that the continents do not move along the substratum but drift from one another due to the appearance of new zones between them. This process is going on deep inside the planet and this caused the fragmentation of the single continent and the formation of the seas and oceans in the gaps between the land masses.

In the two models presented here the Earth appears the way it looked when the continents were joined together, and when the earlier, most ancient

continentnal zones existed. The first model (Figure 2 [omitted]) featured here with some modifications was designed by I. V. Kirillov, while I designed the second one (Figure 3 [omitted]).

On inspection of the first model we can see no Atlantic, Pacific or Indian Oceans on it, while the continents are joined together in an almost identical way to Wegener's model. The zone of the future Pacific Ocean looks quite unusual. In its place there is a long latitudinal gap, north of which lies North America and south of this, South America. Was it possible for the "gap" of the Atlantic Ocean in the past to run meridionally and that of the Pacific Ocean latitudinally?

This would have been impossible if the Earth were not spherical. But since the Earth has nearly an ellipsoid shape, its expansion could proceed at the same rate latitudinally and longitudinally. Thus the Atlantic "gap" began to widen due to latitudinal movements of the continents, while the Pacific "gap" began to widen due to their longitudinal movements. It is these two oceans that have the greatest sizes and it is they that mainly shape the look of the planet.

But why did the Atlantic and Pacific coasts of the Americas drift in such different ways? The reason is that the Earth was smaller in diameter and its surface was therefore more convex. This could have caused the western coasts of both Americas to meet, something which seems impossible with the present size of the Earth.

Kirillov's supplemented diagram is not only convincing geometrically but is also logical geologically. In some respects, in fact, its geological aspect seems to be "more complete" than at present, because the Meso-Cenozoic zone was a single low-latitude strip 100 to 200 million years ago, while today it is split into a number of "small pieces."

The second diagram (Figure 3 [omitted]) shows the state of things in a much earlier period, viz, the end of the Precambrian (nearly one billion years ago). It shows the linkup of the depths of the continents, i.e., their older parts. Canada, for example, was joined with Greenland as well as with Europe's north, in particular with the Kola Peninsula.

Tracing the zones that were directly linked up in the past in difference eras, we can assess the planet's earlier sizes and the rate of its expansion. The rate appears to be gradually increasing, according to our computations. The Earth's size 2.2 billion years ago was only 16 percent of its present size, 1.2 billion years ago the figure was 30 percent, 1 billion years ago it was 37 percent, and 0.1 to 0.2 billion years ago it was 55 percent.

What impact did the Earth's evolution have on wildlife and vegetation?

It is a well-known fact that the coal forests of 300 million years ago consisted to a great extent of giant grasses 10 to 15 metres tall. It is an established fact also that the forests became extinct along with the giant

reptiles. But while no remarkable reasons are advanced to explain the extinction of the forests (they just became obsolete), there is a whole host of hypotheses regarding the dinosaurs: they became extinct because of violent volcanic eruptions, a falling meteorite or an asteroid, the Sun's passage through a meteorite nebula, etc. None of these suppositions, however, considers the possibility that the giant reptiles' extinction was a long process taking millions of years, and one that first killed off their largest forms and later their smaller forms, as well as drove some of them once more into the water (to escape the growing gravity).

These considerations suggest the most probable reason--a gradual growth of the Earth's gravity accompanied by the Earth's expansion (the growth of gravity would not have been possible otherwise).

It should be noted that far from all the proponents of the Earth's expansion concept share the above theory. With the exception of Yarkovsky, Hilgenberg and Kirillov, it is doubted or simply ignored by the majority of researchers. According to Dirac, Jordan and Ivanenko, the gravitational interaction between particles grows weaker, causing the planets and stars to expand.

As regards the problem of the Earth's expansion, it is frequently asked where did all the waters come from that finally filled the oceanic troughs which had formed. As in a first approximation the answer would be the same as in the case of the mass of the Earth itself: the amount of the Earth's water and gases, like the amount of its hard substance, has been growing along the same lines with every growing natural body.

So far, physics has no simply solution to the problem. This does not put the lid on the problem. It makes it a greater challenge. The theory of the expanding Earth wins ever more supporters. The international organization, the Earth Expansion Exchange, promotes the exchange of ideas and information in the field. The hypothesis has already been discussed at an unofficial international and at an all-Union conference.

CSO: 1865/377

KAMCHATKA RADIO TELEMETRIC STATION REGISTERS VOLCANO PULSE

Moscow TASS in English V5-15 20 May 85

[Text] Information which serves as the basis for forecast of volcano erup-
tions is supplied to scientists in the Kamchatka (the Soviet Far East). A
radio telemetric station installed on the slopes of Klychevskaya Sopka
volcano, one of the biggest in Euroasia, is constantly registering the "pulse"
of the volcano and automatically supplies the information to the receiving
station.

This method has already helped to predict the eruption of a number of volcanoes
with high accuracy. Soviet seismologists are creating a system of prompt
collection of geophysical information from areas of seismic activity in the
peninsula. A series of telemetric stations has been designed for the purpose
at the Institute of Volcanology of the Far Eastern Scientific Center of the
USSR Academy of Sciences.

CSO: 1865/377

LASERS MEASURE DRIFTING MOUNTAINS

Moscow TASS in Russian 0447 GMT 12 Apr 85

[Excerpt] Dushanbe, 12 Apr (TASS)--Soviet Tajik scientists have established
with the use of lasers that two mountain ranges in Pamir have moved closer to
each other by half a metre in three decades. By taking regular measurements
with a light beam of the distance between the Karategin and Petr Pervyy
ranges, they noticed a previously undiscovered phenomenon--it transpires that
the two giant ranges sometimes move closer, and sometimes, further apart.

Scientists believe that the drifting is connected with tectonic processes deep
in the Earth and is not disastrous. It is yet another natural phenomenon
which was previously unknown.

[Omitted passage noted that Pamir is situated above the conjuction of two
enormous plates. Scientists are studying the phenomenon at various levels on
Pamir.]

CSO: 1865/377

SUPERDEEP DRILLING RIG TO REACH 15 KM IN WESTERN SIBERIA

Moscow EKONOMICHESKAYA GAZETA in Russian May 85 No. 18 p 5

[Article by Ye. Makarov]

[Excerpt] The workers of the "Uralmash" Association have achieved great labor
successes in the pre-holiday competition. Their latest achievements include
the completion of production of the derrick and other metal structures for the
BU-15000 superdeep drilling rig, which is being built in Western Siberia and
which will be named for Boris Glebovich Muzrukov, the Urals Machinery Plant's
director during the period 1939-1947.

This rig is the third of its kind in the country. Previous ones have reached
depths of eight kilometers on the Apsheron Peninsula, and 12 kilometers on the
Kola Peninsula. The experience with their operation has made it possible to
improve a new design which is intended for drilling to 15 kilometers.

CSO: 1865/371
FTD/SNAP

LAUNCH OF 'KOSMOS-1653' NATURAL RESOURCES RESEARCH SATELLITE

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 24 May 85 p 2

[Excerpt] An artificial Earth satellite, "Kosmos-1653," was launched from the
Soviet Union on May 22, 1985.

Installed on board the satellite is scientific apparatus intended for the
continuation of research of the Earth's natural resources in the interests of
various branches of the USSR's economy and of international cooperation.

The satellite was placed into an orbit with the parameters: initial period of
revolution--89.6 minutes; apogee--322 kilometers; perigee--222 kilometers;
orbit inclination--82.3 degrees.

Incoming information is being transmitted to the State Scientific Research
and Production Center "Priroda" for processing and utilization.

CSO: 1865/371
FTD/SNAP

MUON TOMOGRAPHY USED TO STUDY UNDERGROUND ROCK STRUCTURE

Moscow NTR: PROBLEMY I RESHENIYA in Russian 30 Apr-13 May 85 p 6

[Article by A. Alekseyev]

[Excerpt] A method called muon tomography has been developed by associates of the Moscow Geological Survey Institute (MGRI).

"The flow of cosmic rays," related Candidate of Technical Sciences Vladimir Mikhaylovich Bondarenko, a docent of MGRI, "penetrating the Earth's atmosphere produces a 'downpour' of various elementary particles, including muons. They are capable of penetrating for kilometers into the Earth's depths. These particles can be used as a source for x-raying underground rock and also foundations of engineering structures."

Instruments used for such measurements have been given the name of muon telescopes. Usually they are installed in a tunnel beneath the object to be studied, and the object's density is measured with high accuracy according to the intensity of radiation falling on detectors.

"IIKL-2" instruments, for example, were helpful in the construction of the large radio telescope "RATAN-600" of the USSR Academy of Sciences. At the site that was chosen for it, the underlying rock was a mixture of large and small boulders, sand, clay and pebbles, and ground water was close to the surface. In these conditions, conventional methods were out of the question for precisely evaluating the density and condition of the ground beneath the foundations.

The decision was made to drill 20 boreholes. A small muon telescope was lowered to each of the holes. The invisible particles gave an accurate "portrait" of the geological cross-section of the site.

Muons help to detect hollow spaces in underground rock masses which form as a result of the washing out of soluble rock by ground water, such as in limestone. The recording principle is the same: if such hollow spaces are present in the zone of "visibility" of a muon telescope, the flow of recorded particles increases immediately.

This method can be used for mineral prospecting. When the particles encounter an ore body (which usually is more dense than the surrounding rock), the detectors immediately record a weakening of the flow. Contours of deposits and their reserves thus can be determined and assessed.

UNDERGROUND VOLCANOES DISCOVERED WITH SATELLITE RADAR

Minsk SOVETSKAYA BELORUSSIYA in Russian 23 May 85 p 4

[Text] The craters of two giant volcanoes have been discovered on our planet.
One of them is located beneath the scorching sands of the West Sahara, while
the other is 'warming' the ice of Antarctica in the vicinity of J. Ellsworth
Land.

A radar system developed by Khar'kov scientists in collaboration with
specialists of Moscow and Sevastopol' made it possible to see the craters.
This system is installed on board the Soviet satellites "Cosmos-1500" and
"Cosmos-1602."

CSO: 1865/371
FTD/SNAP

P-WAVE SPECTRA IN PROBLEM OF DETERMINING DYNAMIC PARAMETERS OF EARTHQUAKE FOCI.
STANDARDIZATION OF INITIAL DATA AND PROCEDURES FOR COMPUTING AMPLITUDE SPECTRA

APTEKMAN, Zh. Ya., DARAGAN, S. K., DOLGOPOLOV, D. V., ZAKHAROVA, A. I., ZOBIN, V. M., KOGAN, S. Ya., KORCHAGINA, O. A., MOSKVINA, A. G., POLIKARPOVA, L. A. and CHEPKUNAS, L. S., Earth Physics Institute, USSR Academy of Sciences; Volcanology Institute, Far Eastern Scientific Center, USSR Academy of Sciences

/Abstract/ The focal parameters of earthquakes are commonly determined from the spectra of P-waves, but comparison of the results obtained by different authors for the same event on the basis of different materials often reveals serious discrepancies, as great as an order of magnitude. The authors believe that this situation is not due to any fundamental deficiency of the spectral method, but instead is attributable to the use of different hypotheses and formulas relating the spectral parameters and focal parameters of earthquake foci and the result of lack of a consistent, fully validated approach in the choice of initial material. The thrust of the article is therefore the need for standardizing requirements on the initial material, processing procedures and computation methods. Only with a standard methodology will it be possible to compare and statistically process the collected data. The authors examine each aspect of this problem: choice of initial material; instrumentation used; seismogram quality; signal level; signal-to-noise ratio; choice of length of analyzed segment of record; zero line; beginning and end of interval on record reduced to digital form; digital interval; choice of algorithm for computing spectra; numerical range of spectrum; frequency interval; instrumental correction; averaging of spectra. On the basis of this review and analysis specific recommendations are given on selecting seismograms, their reduction to digital form and computation of the spectra. A second part of the study, to be published later, will deal with reduction of the experimental spectra to the focus and computation of its dynamic parameters. Figures 6; tables 1; references 10: 8 Russian, 2 Western.
/346-5305/

PROSPECTS FOR DEVELOPMENT OF SEISMIC PROSPECTING METHODS AND APPARATUS

TIMOSHIN, Yu. V., Kiev University

/Abstract/ Mobile stations (MS) for exciting oscillations and self-contained reception and registry stations (SRRS) are discussed. These ensure excitation of seismic oscillations on the land and in the water by a contactless method, that is, in the total absence of a mechanical coupling between the source and the ground. Oscillations can be excited during movement, favoring a decrease in the level of random noise and affording possibilities for increasing the productivity of seismic work. This makes it possible to have powerful, economical, ecologically pure surface sources whose effect can be comparable to the effect of shots in boreholes. A number of stages can be defined in the development of such a seismic prospecting system. The first stage involves development of self-contained apparatus for the reception and registry of seismic oscillations mounted on a truck or other vehicle with excellent cross-country capabilities, this being the most important element in the complete mechanization of the entire observation process. The second stage involves development of sources of contactless excitation of oscillations. The third stage involves improvement of means for the reception of oscillations by use of aerial pressure detectors and antennas for the reception of the electromagnetic waves accompanying the propagation of seismic waves in geological media. The fourth stage involves the development of methods and apparatus for the remote contactless reception of seismic oscillations. This will make it possible to avoid the placement of special technical and transportation facilities at the points of reception of oscillations. The proposed program, the possibilities of whose implementation are entirely realistic, will ensure highly productive, completely mechanized and ecologically pure seismic prospecting capable of sharply increasing the productivity of field work, will reduce expenditures and virtually preclude damage to agricultural crops. There would be a great reduction in manual labor in all climatic zones throughout the year on the land and on water in the search for petroleum, gas, coal and ores. References 8: 6 Russian, 2 Western.
/307-5303/

DETERMINATION OF DYNAMIC PARAMETERS OF REFLECTED WAVES ON SLOPES OF DEEP WATER
TRENCH

BYKOV, V. G., VOROB'YEV, F.A., ZHIGULEV, V.V. and SNEGOVSKOY, S.S., Institute
of Tectonics and Geology, Far Eastern Scientific Center, USSR Academy of
Sciences, Khabarovsk; Marine Geology and Geophysics Institute, Far Eastern
Scientific Center, USSR Academy of Sciences, Novoaleksandrovsk

/Abstract/ An attempt is made to determine the absorption and reflection
coefficients in the sedimentary mass of three different sections in the north-
west Pacific in parallel with continuous seismic profiling. The area of studies
is a part of the Kuril-Kamchatka deep water trench. The first section is more
than 100 km from the axis of the trench in an area with a water depth of about
1200 m. The second is located at the base of the ocean slope of the island
structure some 150 km from the trench axis, bottom depth about 1100 m. Section
three is on the oceanic slope of the trench, some 20 km from its main portion.
In all three areas there are two layers of sedimentary deposits differing both
in internal structure and in physical properties. The observed similarities
in structure, lithologic composition and physical properties of the sedimentary
deposits of the oceanic and deep water portions of the continental slope along
the Kuril-Kamchatka trench indicate similarity of the sedimentation process in
these zones as well. Figures 3; references 10: 9 Russian, 1 Western.
/335-6508/

OPTIMAL DENSITY MODEL OF EARTH'S CRUST AND UPPER MANTLE ALONG KAMCHATKA-PACIFIC
GEOTRAVERSE

KRASNYY, M.L., KOSYGIN, V.Yu. and ISAYEV, V.I., Marine Geology and Geophysics
Institute, Far Eastern Scientific Center, USSR Academy of Sciences,
Novoaleksandrovsk; Information-Computer Center, Sakhalingeologiya Production
Geological Association, Yuzhno-Sakhalinsk

/Abstract/ An a priori density model was constructed of a geotraverse from
Kamchatka to the Pacific Ocean on the basis of a seismic model and the known
relationship between velocity and density, extending over 400 km on the surface
and down to a depth of 250 km. Multidimensional modeling was used to solve the
inverse problem producing reliable solutions for 80% of the approximating blocks,
greatly reducing the inaccuracies of the a priori model. It was found that at
great depths the lithospheric plate apparently dissolves (is assimilated into
the mantle). The lithospheric layer beneath the continental block and the

boundary of the ocean section has a thickness of 50 to 60 and 80 km, the mean density of the lithosphere in the continental block being significantly less than that of the oceanic block. Density is reduced beneath the seismofocal zone in both west and east, while the seismofocal zone itself is denser than the asthenosphere and the underlying subasthenosphere layer. Figures 6; references 27: 23 Russian, 4 Western.
/335-6508/

VARIATION IN SEISMICITY UNDER INFLUENCE OF LUNAR-SOLAR TIDAL DEFORMATIONS

RYKUNOV, A.L. and SMIRNOV, V.B., Earth Physics Institute imeni O. Yu. Shmidt, USSR Academy of Sciences; Physics Faculty, Moscow State University

/Abstract/ Studies of the relationship of variations of seismicity to external effects in the past have been based primarily on data from a regional network of seismic stations, resulting in the use of only large, infrequent events. This makes it impossible to use correlation and spectral analysis methods as can be done with higher frequency seismic noise, hindering comparison of the specifics of the response of the medium on various scales. These shortcomings can be avoided by analyzing the time distribution of microearthquakes, which are repeated much more frequently. Observations with highly sensitive and independent recording apparatus were performed in an area of high seismic activity in 1981 on Kamchatka. Microearthquakes were continuously recorded for 24 hours. Analysis of the distribution of these minor earthquakes indicated that there is a correlation between seismicity and tidal effects. The presence of a system of quasiperiodic variations in seismicity was noted. The distribution of microearthquakes varied over time from statistically independent tests. The existence of microearthquakes swarms related to seismicity maxima was noted. Figures 7; references 21: 19 Russian, 2 Western.
/243-6508/

ELECTROMAGNETIC EFFECTS IN CRUSTAL FRACTURING

GOKHBERG, M.B., GUFEL'D, I.L., GERSHENZON, N.I. and PILIPENKO, V.A.,
Earth Physics Institute imeni O. Yu. Shmidt, USSR Academy of Sciences

/Abstract/ The major results from field observation of electromagnetic pre-
cursors of seismic events are presented. These phenomena, including distur-
bances in the atmospheric electric potential, pulsed electromagnetic radiation,
electrotelluric fields and luminous effects, characteristically appear on
the order of hours to days before earthquakes, with earthquakes occurring
during a decrease in the phenomena. The phenomena occur over a broad frequency
range. All anomalies except for electromagnetic radiation have been observed
at the epicenters of earthquakes. Foreshocks have not been recorded during
these anomalies. No "burst" of electromagnetic, atmospheric electric or
electrotelluric fields has been observed at the moment of earthquakes. Electro-
magnetic radiation in the radio frequency band is considered most promising
for earthquake prediction purposes. The specific characteristics of electro-
magnetic radiation caused by seismic phenomena must be determined in order to
distinguish this radiation from other electromagnetic radiation. Figures 2;
references 38: 33 Russian, 3 Western.
/243-6508/

EXPERIENCE IN BREAKING DOWN GRAVITY FIELD INTO COMPONENTS RESULTING FROM
DENSITY HETEROGENEITIES AT VARIOUS DEPTHS (USING NORTH ATLANTIC AND MEDITER-
RANEAN AS EXAMPLES)

ARTEM'YEV, M.Ye., BABAYEVA, T.M., VOYDETSKIY, I. Ye. and MIKHAYLOV, V.O.,
Earth Physics Institute imeni O. Yu. Shmidt, USSR Academy of Sciences

/Abstract/ A spectral analysis of gravity anomalies is presented. The initial
data for the analysis were values of isostatic anomalies in the North Atlantic,
Western Europe and the Mediterranean, averaged in 1 x 1 degree trapezoids based
on published foreign data on the gravity field. The field was divided into
components using a minimum-square Kolmogorov-Wiener filter using an algorithm
which considered the spherical nature of the earth and was suitable for
processing files of up to 10,000 points on a BESM-6 computer. The results
indicate that the study of heterogeneities located deeper than the level of
isostatic compensation requires the use of gravity anomalies after introduction
of corrections for the major surface density heterogeneities and their

isostatic compensation. Subasthenospheric density heterogeneities create gravitational anomalies with wavelengths of 800-1000 km. There are two classes of deep density heterogeneities which appear in the gravity field at wavelengths of between 1000 and 2000 km and greater than 2000 km. The use of the method given in this article with consideration of the statistical characteristics of the field allows successful solution of the problem of isolating individual components in the anomalous gravity field. Accuracy could be increased by eliminating from the analysis the isostatic gravity force field anomaly component with a wavelength over 1000 km. Figures 6; references 13: 11 Russian, 2 Western.
[243-6508]

HYPOCENTRAL AREAS OF AFTERSHOCKS AND POSSIBLE FAULT SYSTEMS AT FOCI OF TSUNAMI-GENERATING KURIL EARTHQUAKES

SOLOV'YEV, S.L. and KECHEKEZYAN, K.A., Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences; Moscow State University imeni M. V. Lomonosov

[Abstract] While acknowledging the limited capabilties and low reliability of the aftershock method of analyzing processes at the foci of earthquakes, particularly in the Kuril-Kamchatka area, it was still decided to use this method as the only possible one to study the foci of five comparatively recent tsunami-generating Kuril earthquakes. The results of the analysis were compared with available information on the tectonics of the island slope of the Kuril deep water trench. Data on the foci of the tsunamis and intensity of the waves were the result of standard determination of the focal mechanism. The five earthquakes all had a magnitude greater than 7 and occurred between 1969 and 1975. The results indicate that the model of a single fault presently used to describe processes of foci of tsunami-generating and strong Kuril-Kamchatka earthquakes in general is not sufficient and is too arbitrary. More effective methods of reconstructing these processes must be developed, since they may well consist of movements along several faults simultaneously. Figures 6; tables 2; references 27: 21 Russian, 6 Western.
[243-6508]

35

METHOD AND RESULTS OF ELECTROMETRIC OBSERVATIONS IN SEISMICALLY ACTIVE REGION

OSTASHEVSKIY, M. G. and SIDORIN, A. Ya., Earth Physics Institute imeni O. Yu.
Shmidt, USSR Academy of Sciences, Moscow

/Abstract/ Any increase in the accuracy of measurement of rock impedance will
afford new possibilities for diagnosis of its state and use of the electro-
metric method in research on earthquake prediction. It has been postulated
that due to the nonstationary and correlated nature of the noise against whose
background measurements are made in electrical probing, the use of accumula-
tion methods for solution of this problem is ineffective. The article des-
cribes the fundamental principles and methods for contending with noise in
electrical sounding which make possible a considerable increase in the ineffi-
ciency of accumulation and gives some results of observations of variations of
impedance in the Garm geophysical test range in the seismically active part
of the Tajik SSR obtained using algorithms, instruments and equipment developed
by the authors. An optimum accumulation algorithm was developed on the basis
of the statistical properties of a large number of records of noise observed
during electrical sounding. The great volume of research data ensured full
automation of the experiment by direct input of data from a precise digital
measuring instrument into a minicomputer where they were processed using dif-
ferent algorithms at a real time scale. Measurements are made once a day in
half-hour intervals. The pulse repetition rate was 24 sec and the duration
of one accumulation cycle was 132 sec. In one sounding session it was possible
to obtain results for 10-15 accumulation cycles. These data were used in
determining the mean impedance value and its dispersion. The results indicate
the desirability of using current sources of intermediate power in combination
with the proposed methods for contending with noise in electrical probing of
the crust, including in the search for earthquake precursors. In comparison
with use of MHD generators this not only reduces costs considerably, but also
increases the accuracy and reliability of measurements. Figures 3; references
6: 5 Russian, 1 Western.
/354-5303/

SEISMIC EFFECT OF UNDERGROUND BLASTS AND PROBLEM OF ESTIMATING TOTAL EARTH-QUAKE ENERGY

SADOVSKIY, M.A., academician, KEDROV, O.K., LAUSHKIN, V.A. and PASECHNIK, I.L., Earth Physics Institute imeni O. Yu. Shmidt, USSR Academy of Sciences, Moscow

/Abstract/ An estimate is presented of the upper limit of total earthquake energy based on seismic energy determined by remote seismic measurement of P waves using records of American underground nuclear blasts with known source energy. The work is a contribution to the formulation of an absolute energy scale for earthquakes based on records of P waves from 99 underground blasts in the continental USA and on Amchitka Island. Records were obtained at two experimental stations in the USSR located at distances of 60 and 90 degrees from the epicenters of the blasts. The events were recorded in a three-component short-period channel with a gain of $2 \cdot 10^5$ at 1 Hz. It is found necessary to consider signal frequency in determining the absorption coefficient. The most objective energy estimates can be obtained if integration includes only the focal P wave, suppressing P-coda oscillations by frequency and polarization filtration. Calculations should be performed in the frequency range rather than in the time range, though comparable results are produced by the two methods in the first approximation. An equation is presented for energy as a function of magnitude: $\log E_c = 1.7 \, m_{PV} + 9.3$. The seismic effect of an underground blast depends upon the surrounding medium and is 0.3% for a loose medium, 3% for a medium of moderate density and on the order of 6% for a dense medium. Equations are derived relating seismic and total energy which can be considered an upper limit of total energy for earthquakes. Figures 1, tables 1; references 12: 8 Russian, 4 Western. /336-6508/

TECTONICS OF EASTERN KRONOTSKIY PENINSULA AND FORMATIONAL ASSOCIATION OF BASALTS (KAMCHATKA)

RAZNITSIN, Yu.N., KHUBUNAYA, S.A. and TSUKANOV, N.V., Geology Institute, USSR Academy of Sciences; Volcanology Institute, Far Eastern Scientific Center, USSR Academy of Sciences

/Abstract/ Results are presented from combined tectonic and geochemical studies of Cretaceous and Paleogene effusive-pyroclastic and tuffogenous-silicaceous formations in the eastern Kronotskiy Peninsula. The region of studies is a

part of the eastern Kamchatka Peninsula in the immediate vicinity of the
island slope of the Kuril-Kamchatka deep water trench. The studies allow a
new interpretation of the structure of this region and the relationship of
ultrabasic rocks to their surroundings. The studies establish a cover-flake
structure for the Late Cretaceous formations proving them to be of Senonian
age. For the first time, a serpentinite melange is described in eastern
Kamchatka, present at the base of overthrust planes and also making up several
independent plates and small protrusions. It is concluded that there was
Late Cretaceous obduction on the ocean side, the melange and ultrabasites
belonging to the base of the eugeosynclinal area. The Upper Cretaceous and
Paleogenic formations belong to the island arcs in their early stages of
development. A new transition zone from the ocean to the continent, a sharply
arched volcanic-plutonic high-alumina plagiotholeiitic province is distinguished
on the basis of petrochemical and geochemical data. Figures 2; tables 1;
references 40: 30 Russian, 10 Western.
/242-6508/

GEODYNAMICS OF CRUSTAL DILATATION IN TRANSITION AREA FROM ASIAN CONTINENT
TO PACIFIC OCEAN

UTKIN, V.P., Far Eastern Geology Institute, Far Eastern Scientific Center,
USSR Academy of Sciences

/Abstract/ A study is presented of the kinematics of deep fractures in the
Asian-Pacific transition zone in order to establish the regularities of
motion of the Asian and Pacific geoblocks in time and space. Crustal
dilatation is shown to result from shear activation of deep faults. The
major kinematic systems of deep faults are diagrammed. A close genetic
relationship is demonstrated between volcanism, intrusive magmatism and
orogenesis and the shear activation of deep faults. The specifics of
spatial interrelationship of the various folded dislocation elements corres-
pond to the organization of structures with lateral displacement of the Asian
continent toward the southwest and movement of the Pacific and Kula plates
toward the northeast. The volcanogenic belt is controlled by straight deep
faults, and only superficial analysis by other investigators has allowed
many of them to consider parts of the belt to be arc-shaped. Establishment
of the specifics of the evolutionary development of shear dislocations is
very important for a solution of the problem of space and time relationships
among various forms of plicative and destructive structures in the zone. The
geodynamics of dilatation of the continental crust established in the Sikhote-
Alin explain the formation of the marginal seas and deep continental depres-
sions, which were particularly common in the Cenozoic. Figures 4; references
38: 22 Russian, 16 Western.
/242-6508/

RELATIONSHIP AMONG THE URALS, PAI KHOI, NOVAYA ZEMLYA AND TAYMYR

USTRITSKIY, V.I., All-Union Scientific Research Institute of Marine Geology, Leningrad

/Abstract/ A study is presented of the history of development of the regions mentioned in the title by analysis of facial zonality of deposits and interpretation of data obtained in the Kara Sea with geophysical data taken into account. The analysis is based on materials collected by the author in his study of Paleozoic deposits of Pai Khoi, Novaya Zemlya and Taymyr over a number of years. Five stages in the development of the area are distinguished. It is concluded that during the Middle Paleozoic a single ocean basin extended from the Urals through the southern Kara Sea to Taymyr. Hercynian folding appeared in the Urals and Taymyr separately. During almost the entire Late Paleozoic, almost up to the end of the Permian, in most of the southern Kara depression there was an isolated oceanic basin, a relict of the Middle Paleozoic extensive Urals-Taymyr ocean. On Pai Khoi and Novaya Zemlya the Hercynian movements did not appear at all. Figures 3; references 23 Russian.
/242-6508/

PARTICIPANTS IN COSMIC PLASMA SHOCK WAVE PROJECT IDENTIFIED

Moscow PRAVDA in Russian 27 Apr 85 p 6

[Article by A. Tarasov]

[Abstract] The article briefly describes the purpose and organization of the Soviet-Czechoslovak "Intershok" experiment to study shock waves caused by cosmic plasma, which is being carried out with the aid of the "Prognoz-10" satellite. It is noted that the instruments on the satellite include a radiometer tuned to the sun's radio emissions, a wave-complex transducer which records energy particles of solar and cosmic rays, and an x-ray photometer which detects the beginning of a solar flare according to x-radiation.

It is reported that in addition to the USSR Academy of Sciences' Institute of Space Research and the Astronomy Institute of the Czechoslovak Academy of Sciences, other participants in the experiment include the USSR Academy of Sciences' Institute of Earth Magnetism, the Ionosphere and Propagation of Radio Waves, the State Astronomy Institute imeni Shternberg, the Ukrainian Academy of Sciences' L'vov Physical-Mechanical Institute, and the Charles University in Prague.

CSO: 1865/371
FTD/SNAP

TRANSMISSION OF TROPOSPHERIC RADIATIONS OF LASERS ON MOLECULES OF DIFFERENT CARBON DIOXIDE ISOTOPES

AREF'YEV, V. N., Institute of Experimental Meteorology, Obninsk, Kaluga Oblast

[Abstract] CO_2 lasers operating in different lines of the bands $00^0 1$-$10^0 0$ and $00^0 1$-$02^0 0$ of molecules of different carbon dioxide isotopes are coming into increasing use for remote measurements of the parameters of the gas composition of the atmosphere. Their generation spectrum coincides with the window of relative atmospheric transparency 8-13 μm. However, the solution of many problems requires a reliable knowledge of the parameters of molecular absorption of the emission of CO_2 lasers in the troposphere. The theoretical possibility of generation of laser radiation in 960 lines of seven CO_2 isotopes ($^{12}C^{16}O_2$, $^{12}C^{18}O_2$, $^{16}O^{12}C^{18}O$, $^{13}C^{16}O_2$, $^{13}C^{18}O_2$, $^{14}C^{16}O_2$, $^{14}C^{18}O_2$) has been demonstrated, but computations of molecular absorption of laser radiation by the atmosphere have been made only for the main isotope $^{12}C^{16}O_2$. In order to fill this gap partially the authors give the results of computations of the transmission of laser radiation on seven isotopes of carbon dioxide by the tropospheric layer during summer in the middle latitudes of the northern hemisphere. A table gives the computed coefficients of molecular absorption for a $^{12}C^{16}O_2$ laser in the surface layer at altitudes 5 and 10 km and the vertical optical thickness τ of the troposphere to an altitude 11 km. The most transparent microwindow has a transmission of 80-85% in the region 10 μm, where losses for the most part are determined by the continuous absorption of water vapor. The computations make it possible to analyze the contribution of each gas to the total attenuation of the radiation of CO_2 lasers by the atmosphere due to molecular absorption. (It is noted that detailed tables of the co-efficients of molecular absorption in the surface air layer and optical thicknesses of the troposphere for the radiation of CO_2 lasers on seven isotopes of carbon dioxide in summer and winter were published by R. M. Akimenko, et al. in TRUDY IEM, No 18 (119), 129, 1984.) Tables 1; references 13: 10 Russian, 3 Western.
[343-5303]

NATURAL ECONOMIC CONDITIONS AND POSSIBILITIES OF ORGANIZING GEOSYSTEM MONITOR-
ING AT TSIMLYANSK SCIENTIFIC STATION, ATMOSPHERIC PHYSICS INSTITUTE, USSR
Academy of Sciences

DOBRODEYEV, V. G., KASHKAROVA, V.P., SYCHEVA, S. A., UTEKHIN, V. D. and
FIRSENKOVA, V. M., Geography Institute, USSR Academy of Sciences

/Abstract/ Attempts are now being made at organization of geosystem monitoring.
This is the monitoring of the reciprocal influence of regional natural and
socio-economic systems. Geosystems monitoring includes observations of the
natural dynamics of the atmosphere, vegetation and soils and anthropogenic
influences on nature: effects of construction, cultivation, grazing and
recreation, especially changes in bioproductivity, erosion and environmental
pollution. Such monitoring is especially desirable in regions of strong
economic development. Such monitoring would best be carried out at nearby
natural preserves for which long series of observational data are available.
Among these is the Tsimlyansk Scientific Station of the Atmospheric Physics
Institute. It is located in a dynamically developing region and observations
have already been made for a number of decades. The station has an area of
1 km^2 with a natural soil and vegetation cover. The purpose of this article
is a brief geographical description of the territory. The most important
feature in this area is the Tsimlyanskoye Reservoir, constructed in 1952, which
has radically changed the environment in this region of the Lower Don. The
reservoir has exerted a considerable influence on relief and relief forming-
factors. A definite microclimate has formed in the neighborhood of the reser-
voir. The station is definitely representative of an extensive area. The
main purpose of a geosystem monitoring station is to detect trends in multi-
layer anthropogenic changes in natural conditions. References: 5 Russian.
/358-5305/

ATMOSPHERIC TURBULENCE INVESTIGATIONS AT TSIMLYANSK SCIENTIFIC STATION, ATMOS-
PHERIC PHYSICS INSTITUTE, USSR ACADEMY OF SCIENCES

TSVANG, L. R., Atmospheric Physics Institute, USSR Academy of Sciences

/Abstract/ The Tsimlyansk Scientific Station of the Atmospheric Physics
Institute was established in 1957. It is situated in a level, uncultivated
steppe sector surrounded by cultivated lands. A diagram shows the actual
layout of the station, which consists of a service sector and a measurement

sector. Measurements are made in a level, uniform area of virgin steppe measuring 700 x 650 m. There are laboratories and residential quarters. There is an underground facility from which remote measurements can be made. There is a 40-m mast which carries 6 sets of sensors for measuring the vertical profiles of wind velocity and temperature in the range of heights from 1 to 32 m and a mobile carrier with a set of sensors (acoustic anemometer, resistance thermometer) for measuring fluctuations of the three components of wind velocity and temperature in this same range of heights. In the Tsimlyansk area there are few clouds and little precipitation and northerly and northeasterly winds predominate, providing favorable conditions for carrying out regular measurements of turbulence and related phenomena in the atmospheric surface layer. The fact that the station is in the steppe, with a uniform surface extending for many hundreds of kilometers, makes it easy to combine surface and aerial observations. The most important work done during the last 25 years is reviewed and the most important work to be done in the future is outlined. Such work will include study of processes of interaction between the atmosphere and the underlying surface under nonstationary conditions, especially in the presence of variable cloud cover, with allowance for the influence of radiational nonuniformity of the underlying surface, for developing a model of turbulent processes transpiring under the conditions most frequently observed in nature. These same processes must be investigated with a stable atmospheric stratification, with the use of acoustic and radioacoustic sounding and local surface measurements of characteristics of the surface and lower part of the atmospheric boundary layers. Spaced high masts, acoustic and radioacoustic sounding methods must be used in evaluating the role of different mechanisms in the processes of transfer of heat and momentum in the surface and boundary layers. An experimental determination of all the terms in the Reynolds equation and in the equation for the balance of turbulent energy would provide useful tools for such research. Figures 3; references 30: 22 Russian, 8 Western.
/358-5303/

HUMIDITY PROFILE MEASUREMENTS IN ATMOSPHERIC LOWER LAYER BY SPONTANEOUS RAMAN SCATTERING METHOD

BUKIN, O. A., STOLYARCHUK, S. Yu. and TYAPKIN, V. A.

/Abstract/ A YAG: Nd laser with a mean power of 1.7 W in a field variant of a spontaneous Raman scattering lidar, installed aboard a scientific research ship, was used in measuring atmospheric humidity profiles to heights $\sim$500 m with a vertical resolution of 84 m with an error not exceeding 14% at the end of the measurement path in a time of about 15 minutes. The sounding was carried out in a monostatic scheme with the simultaneous reception of two wavelengths of spontaneous Raman scattering returned from water vapor and nitrogen. This procedure made it possible to take light attenuation along the path into account as correctly as possible, to exclude fluctuations in source intensity

and to facilitate the process of determining the lidar instrument constant. The field variant of the lidar used was a modification of an instrument developed earlier by the authors (O. A. Bukin, et al., ZhPS, Vol 38, No 5, pp 776-779, 1983). This lidar was used in sounding along horizontal and slant paths with a sounding angle variable from 0 to 70°. On shipboard the sounding was at an angle of 16° to the horizon along a slant path with subsequent retrieval of the vertical humidity profile. Laser sounding was simultaneously accompanied by humidity measurement with a psychrometer; the agreement between the laser and standard measurements was good. The humidity profiles were obtained at nighttime when atmospheric transparency was good. Measurement of a series of water vapor profiles during the night made it possible to determine the temporal variability of the humidity field in the lower surface layer of the atmosphere over the ocean. Figures 4; tables 1; references 14: 9 Russian, 5 Western.

/376-530_7

SOME CHARACTERISTICS OF TRANSMISSION BY THIN CLOUDS IN VISIBLE AND INFRARED SPECTRAL REGIONS

GEORGIYEVSKIY, Yu. S. and SHUKUROV, A. Kh., Atmospheric Physics Institute, USSR Academy of Sciences

/Abstract_7 The article gives the results of investigations of attenuation of radiation by thin cirrus (not less than 100 spectra) and cumulus clouds or their margins (more than 100 spectra) under spring, summer and autumn conditions in a moderately moist climatic zone in five parts of the visible and IR spectral regions. Since the principal difficulty in measuring transmission through clouds is their great temporal and spatial variability, the method proposed by H. Grast (BEIT. PHYS. ATMOS., Vol 43, No 4, 1970) was used for measuring transmission through clouds simultaneously at several wavelengths. The study was made using a laboratory apparatus developed earlier by the authors (IZV. AN SSSR: FAO, Vol 12, No 3, 1974). A solar radiation flux was directed into the laboratory room by an ATsU-24 coelostat situated in a tower at a height of 15 m. It was found that cirrus clouds are more transparent (over 80% of the cases) in the visible range, whereas cumulus clouds are more transparent in the IR range (100% of the cases). This information can be used in the reliable discrimination of ice and liquid-droplet clouds on the basis of data from remote measurements. In most cases the transmission of thin cumulus clouds in the near- and middle-IR ranges (1-13 μm) can be satisfactorily described by a gamma distribution of particles in a cloud with the parameters $\mu = 2$ and $\bar{a} = 3\mu$m ($\bar{a}$ is the mean size of gamma distribution particles). The excess of observed optical thickness over the computed value in the visible spectral region is attributable to additional attenuation of radiation by the fraction of

water-enveloped condensation nuclei. In many cases clouds are observed which have an optical thickness maximum at $\lambda = 1.6\,\mu\text{m}$. This can be evidence of the existence of fine-droplet clouds with $\bar{a} = 1\mu\text{m}$ under real conditions. Figures 4; references 15: 14 Russian, 1 Western.
/353-530_7/

NEW TEAMS, LOCATIONS OF ARCTIC DRIFTING STATIONS

Yerevan KOMMUNIST in Russian 14 May 85 p 1

[Text] Leningrad--The banner of a new scientific team has been raised over
the camp of the drifting station "Severnyy polyus-26" (SP-26). This was
radioed from the Central Arctic by N. Blinov, an eminent polar researcher and
the new head of the station's staff. This is the third team of scientists and
specialists to take over duty on the ice floe, which began its Arctic odyssey
north of Wrangel Island three years ago.

The path of SP-26 became an unusual and complex one, but one which is
extremely interesting and important from the scientific standpoint. Under
the effects of currents and the wind, the ice floe was drawn into a so-called
anticyclonic circular drift in the area of the pole of relative inaccessi-
bility--the points which are the most remote from the continental coast. (Up
until now, only one station--SP-22--had been in this area.)

The ice floe of SP-26 has now been located in practically the same place for
three months, affording a rare opportunity for prolonged comprehensive
observations of processes in the ocean and the atmosphere.

A different fate, from the viewpoint of ice forecasters, awaits the second
Soviet drifting station, "Severnyy polyus-27," where replacement of scientific
personnel has also taken place. This ice floe has drifted northwest of the
New Siberian Islands, and it will be eventually carried out to the Greenland
Sea through the region near the pole. .

CSO: 1865/371
FTD/SNAP

AIRBORNE FACSIMILE SENDER USED FOR ICE RECONNAISSANCE

Moscow VOZDUSHNYY TRANSPORT in Russian 14 May 85 p 4

[Article by A. Murlin]

[Excerpt] For four months, airmen and hydrologists have been working in the Arctic Ocean. On board an ice-reconnaissance AN-24 airplane, a study of the ice cover is being conducted over a distance of 10,000 kilometers, from Murmansk to Uelen. The expedition is headed by specialists of the Arctic and Antarctic Scientific Research Institute of the USSR State Committee on Hydrometeorology and Monitoring of the Natural Environment (AANII).

"Every year at the beginning of January, our crew sets out on such flights," said Pilot 1st Class M. Kulachenkov, the commander of the AN-24 airplane. Special equipment is set up on board the airplane, including the 'Ladoga' facsimile sender. With the aid of this equipment, the airborne hydrologists are able to conduct not only visual but also instrument aerial surveying."

"For several years in a row, such work has been done by a team from our institute's department of ice conditions and forecasting," continued I. Serebrennikov, senior engineer-hydrologist of AANII's department for improvement of the system and methods of ice observations. "We have made it our main task to collect up-to-date information on the ice cover for computer processing. This will make it possible to have not only short-term but also long-term forecasts for the shipping routes of freighter convoys, icebreakers and fishing vessels."

CSO: 1865/371
FTD/SNAP

SPRING AIRLIFT TO SP-26 ARCTIC DRIFTING STATION COMPLETED

Moscow VOZDUSHNYY TRANSPORT in Russian 14 May 85 p 4

[Article by M. Il'ves]

[Abstract] The article reports briefly on the final spring operations for supplying the "SP-26" arctic drifting station. One of the last flights to the station was made by an IL-14 airplane, which flew 2,200 kilometers from the mainland to the station's ice floe, which was located at coordinates 82 degrees 16 minutes North latitude and 164 degrees 33 minutes West longitude. It is noted that as many as six flights a day have been made to the station by aviators of the spring aerial expedition "Sever," delivering replacements for the station's crew in addition to supplies and equipment. The head of "SP-26" is V. Sidorov, who recently turned 60.

CSO: 1865/371
FTD/SNAP

EFFICIENCY OF THERMAL SENSING APPARATUS IN ICE RECONNAISSANCE

OVSYANNIKOV, V. A.

/Abstract/ Some quantitative aspects of aerial thermal sensing surveys for
study of snow and ice conditions were investigated. The case of stationary heat
exchange between water, ice and snow cover is examined. As a simplification
the snow and ice covers are considered uniform in thickness. Formulas are
derived showing that the use of airborne thermal sensing equipment with a detec-
table temperature difference 0.2-0.3 K in ice reconnaissance under typical
conditions ensures determination of differences in ice thickness $\sim$ 0.2 m.
When a snow cover is present the error in measuring ice thickness by thermal
sensing is determined primarily by the error in estimating thickness and
density of this cover. This error, in the case of snow-free ice fields, is
dependent for the most part on instrument accuracy. In estimating the thickness
of thin ice, between 0.3 and 0.5 m, it is best to use a method essentially
involving measurement of the temperature difference between sectors of open
water and the snow-ice cover. The thermal contrasts of the ice field itself
must be measured when the ice has a great thickness. The expressions derived
in this article make it possible to evaluate the influence of different factors
on the reliability of remote ice reconnaissance. References: 5 Russian.
/374-5303/

CSO: 1865 - END -